THE JOURNAL OF GEOGRAPHY

VOL. VII JUNE, 1909 No. 10

PHYSIOGRAPHY:—AN ELEMENTARY SCIENCE COURSE IN THE HIGH SCHOOL

By HAROLD W. FAIRBANKS, PH.D.
Berkeley, California

THE question as to the place which geography should occupy in the high school and its relation to elementary science is an important one at the present time.

By general consent the formal study of what is commonly called physical geography has been left to the high-school period. Owing, however, to the failure on the part of many teachers to understand the full significance and scope of the subject, it has not gained the recognition which it deserves. Besides this, many teachers feel the need of an elementary science course which shall precede and give some preparation for formal chemistry, physics, and biology, and they do not see in geography anything that can fill this need.

In the following paper I hope to show that physical geography, or physiography as I prefer to call it, when viewed from a broad and rational standpoint, can be made to include not only all of geography that is needed in the average high-school course, but also all that is important in an elementary science course. I hope to show further that physiography has a great advantage over an elementary science course in that it presents the subject matter from an intelligent and comprehensive viewpoint.

A course in merely elementary science, adapted to the first year of the high school, would group in a disorderly jumble unrelated facts from many widely different fields. If these same facts were taken up from the geographic viewpoint they would naturally fall into an organized whole or cosmos, giving the student an intelligent outlook on nature. The geographic concept alone can form the binding cement. It looks at all

facts according to the part which they play in the activities of the world as a whole.

While it matters little whether we call this subject physical geography or physiography, yet it is important that there should grow up a common usage so that we shall know just what is intended to be conveyed when the matter is mentioned. By many teachers these terms are used synonymously. Some understand physiography to apply to land forms alone, and physical geography to be of wider application but without any emphasis upon life. Still others are inclined to use the term physiography in the sense in which Huxley introduced it, that is, a study of nature based upon observation.

To my mind the term physiography seems to designate more fittingly than any other that newer conception of our subject which leads us to take up a study of the phenomena of the world about us, not for their own intrinsic values, but for those far more valuable results which can be obtained only when they are considered in the light of their relation to each other and to the world as a whole.

Physiography is then more than the study of land forms. It is more than physical geography with its formal laboratory work. It includes in short the elements of all the sciences from the geographic viewpoint, the work being based at every step upon the observation of real things.

The study of physiography as thus defined leads to a broad, intelligent outlook upon nature, fits the stage of development of pupils entering the high school, is introductory to much that follows, and for these reasons should be made a required study for every one.

Geography is the mother of the sciences. It once included all that was known of nature, and was purely descriptive until very recent times. Its boundaries have always been ill-defined, and are so to-day in the minds of most teachers. With the growth of inquiry into cause and effect and the growing recognition of the individuality of the subject, geography is rapidly becoming a science. It offers wide fields of research to the university student, as well as a fundamental insight into nature for both grammar and high-school pupils.

There is nothing that can fill the gap between the geography and nature study of the grades and the sciences of the later years of the high school so well as physiography. Its outlook is comprehensive, and, if properly taught, so interesting that the pupil is placed in the best possible attitude toward formal science.

We must constantly bear in mind in this elementary science course that it is the geographic concept which is the important thing, and that this must be placed foremost at all times. Now let us see in detail the advantages which physiography possesses over every other science as an introductory course in the high school.

Physics has been emphasized in high schools because of university requirements. It is a formal laboratory course in which the practical side, so important from the standpoint of young pupils, is not brought out.

A course in elementary physics has been suggested for the first year in the high school, as filling the need of an elementary science course. The same objection can be raised to such a course as to a similar course in each of the other sciences, and this objection is that it introduces formal specialized work when a broader treatment of science as a whole is much more fitting. The knowledge gained by taking up the facts of science from the standpoint of their geographic relations is infinitely more valuable at this period than when these facts are studied for their own sakes.

Physiography takes up the elements of physics as illustrated in the behavior of the earth, the water, and the air, and their relation to living things. It may be argued that this is not geography, but physics. I will say in reply that physical conditions enter into geographical problems, and we can not separate them without destroying the content of geography. The pupil should have become familiar with many simple physical problems in the last years of the grammar school, but if he has not it is perfectly right as well as necessary to introduce them whenever by so doing we make the meaning of the geographic facts clearer.

It can be said of chemistry also that many of its phenomena are illustrated in the experiences of every-day life. These experiences have their geographical aspect which ties them up to life and chemical changes viewed in their relation to the earth as a whole.

In biology we take up the development, structure, and classification of living things. We study them for their own sakes. In physiography we study life from a wider and more comprehensive standpoint. We look at it from its relation to the physical world. We study the factors governing the distribution and modification of living things, how they have been affected by climate, the food supply, and the relief of the earth's surface.

We have been subject to the influence of physical forces as well as the plants and lower animals. Everything we do is more or less com-

pletely determined by our environment. In our racial as well as our individual histories it was the *tout ensemble* of the phenomena about us, as they were related to our ill or well-being, that first attracted our attention rather than the facts arrived at in later years through analysis. This should aid us in arranging our scientific studies in their proper order.

Physiography is simpler and in every way more suitable for high-school pupils than is geology. The study of the origin and changes of land forms offers a good foundation for geology both through its actual content and through its training of the observational powers. While it is true that geological problems enter into a complete understanding of the meaning of land forms as illustrated particularly in movements of the earth's surface and the formation of rocks and minerals, yet these can be made simple and easily understandable for the purpose in hand.

In geology we study a volcano as an end in itself. We inquire into the causes of its origin, its materials and its physical history. In physiography these things are gone into only in sufficient detail to make plain the relation of volcanoes to climate, soil, distribution of plants and animals, and finally man and his activities.

Meteorology forms an extremely important part of physiography. Through its study many problems in physics and chemistry find practical application. Man can overcome to a considerable degree obstacles presented by land and water, but he is almost completely at the mercy of the air. The climates of the earth are in large measure dependent upon its movements.

Oceanography also enters into our subject. The currents and tides of the ocean, together with its influence upon climate, and the living things which it supports, round out our study of the earth.

Astronomical geography introduces us to the earth as a member of the solar system. That part, however, which is of especial importance to physiography has to do with climate as related to daily and seasonal changes.

The dependence of man upon all of the above-mentioned physical conditions, how in every place and at all times he is more or less at their mercy, should be made most emphatic in a properly arranged course in physiography. Man is the highest product of the cosmic forces, and while there can be a real geography without him, yet his presence makes possible a knowledge of its meaning.

The geography of agriculture is more important to the average high-school pupil than is agriculture undertaken for its own ends. It introduces him to an elementary study of rocks and how they decay to form soil. It takes up the distribution of different kinds of soil as related to rocks, to slope and to climate. It finally brings out the intimate connection which exists between the soil and the industries of man and his spread over the earth.

The formation and distribution of mineral substances should be taken up in connection with physiography, for they exert a powerful influence upon commerce and industries.

The net result to the pupil from a course in physiography made as comprehensive as has been outlined above, will be small if the work is based upon a text-book. If we go to the other extreme and base it upon in-door laboratory work the result is almost as bad. In either case he is lacking in ability to apply his knowledge to the world of real things. That kind of geographic knowledge which possesses practical utility finds its first and most important elucidation in the phenomena open to observation all about us. The ideal course in physiography being based largely upon observation must vary more or less with the materials at hand in different places, and its laboratory is preëminently out of doors. Laboratory work in physics, chemistry, and biology deals with practically the same principles and illustrations everywhere. It is more formal and pays little attention to the surroundings of the pupil.

The main aim in a course in physiography should not be the acquirement of book facts, or of the so-called laboratory methods, but rather to so familiarize the pupil with the phenomena of the land, the water, and the air in their relation to each other and to living things, that he can at any time, and wherever he may be, interpret them with a reasonable degree of certainty. For example, training in the principles and use of meteorological instruments is physics, and has no geographic content. Most pupils leave school and never have anything to do with such instruments in after years. Such training must be supplemented by observations made out of doors upon actual weather phenomena. The ability to interpret the signs of the sky gained through observation, and aided when possible by meteorological instruments, is the thing that will prove of importance in life. This knowledge is strictly geographic in its nature, and when once acquired can be made of use in any part of the earth.

The only regional geography that should be introduced into a course

in physiography is that which helps the main thought of the subject, which is the gaining of a working knowledge of the geographic relations existing in all phenomena.

All the commercial geography which will do the first-year high-school pupil any good is that which can be worked in similarly to regional geography. When the main conceptions of physiography are recognized by teachers, the question as to what should be included and what excluded will no longer give any trouble.

We may say, then, that a course in physiography or physical geography fails of accomplishing its main ends if the pupil goes out from school unable to interpret the facts of his physical and vital surroundings in relation to himself and to the world as a whole. The memorizing of facts from a text-book, whether in the grammar school, high school or university, is largely useless, for the most of them will be forgotten. The ability to interpret nature is no more going to be forgotten than is the ability to swim when once acquired, though it be not practised for years.

From the standpoint of geography the earth may be considered an organism upon whose surface multitudes of living things carry on their activities subject to physical laws. Latitude, direction of the wind and ocean currents, distance from large bodies of water and elevation are all concerned, bringing in an infinite variety of physical problems. The manner in which the sciences have developed, from the general to the particular, should teach us, if nothing else does, that this broad geographic view of nature should come before any specialized science. We should learn something about the organism as a whole before we dissect and analyze it.

Physiography as I view it is a true science of wonderfully wide adaptiveness. In its simple interpretation it is more suited to immature minds than formal analytical science, for it sees things in their large relations and in wholes. In its deeper aspects physiography offers unlimited opportunities for advanced students through its world-wide inclusion of all physical and vital relations. It might be called a universal science, and thus viewed approaches philosophy. Thus the subject may be made of the highest advantage both to the pupils who leave school at an early age, and to those who expect to continue its study in later years.

Let us now consider the relative importance of the different factors entering into a course in physiography. Geography is not a heterogeneous aggregate of facts about the earth. It is no longer purely descriptive, but seeks for causes and effects, and the inter-relations between all

phenomena. It seems irrational to speak of geography as the "study of the earth as the home of man." This statement seems to imply that there could be no geography without man. If a rational being were examining the earth from an exterior point, the presence or absence of man could in nowise affect the development of a science of geography.

Many teachers are of late coming to hold that too much attention has been given land forms to the neglect of other and more vital phases of the subject. There can be little doubt that much of the modern teaching of physical geography, although showing a great advance upon earlier years, is open to serious criticism. In the reaction from the purely text-book methods and the introduction of laboratory work, much of the latter following after physics has become too formal.

The study of land forms in the newer teaching has not been properly adapted to the needs of high-school pupils. It has been made an end in itself rather than a foundation for the wide field of geographic influences and relations.

When, however, we call to mind the dependence of living things upon the character of the land and its relation to the water, we can not, if we go at it rightly, emphasize that side of our subject too strongly. Except in regions of low relief and wide extent of similar physical conditions, the influence of slope and elevation is so marked that we can not escape it.

There can be little question that in most courses of high-school physiography the life side is neglected. The text-books generally slight this phase, and it is little wonder that the teachers follow them.

We should interweave with our study of land forms the definite relations which exist between them and living things. Each successive stage in the development of the land has its own particular influence upon climate and life. The elevation of a mountain range may completely change the climate of an interior region, and with this change come modifications of the fauna and flora.

A worn-down range will cease to condense much of the moisture of the passing storms, and a well-watered region becomes uninhabitable. Such great changes as these are illustrated in some of the features of California, and taken together with the almost infinite number of important but less striking influences which are observed everywhere, the lands and their evolution form one of the most important branches of physiography.

It is only through an understanding of the effect of the relief of the

land upon life that the history of the human race can be understood. We should not let the thought that man is the most important product of the earth minimize the importance of a knowledge of the physical conditions under which he has gained his present position.

If we make physiography an elementary science in which the underlying principle is geographic, the work must be based upon observation and experiment. A knowledge of the physical relations existing in the home region must form the basis of any extended study. The ability to interpret the surrounding physical and life conditions is the essential thing, and from this we can extend the work to our own country and the world at large.

In arranging a course in physiography emphasis should be laid upon what is at hand and open to investigation, while those phases of the subject of which little illustrative material can be had should be put in the background. For example, it would not be wise in such a course as I have in mind for a school situated in the heart of the Mississippi Valley, far from any volcanic phenomena, to make a special study of volcanoes.

The pupils can gather something from specimens, from pictures, and descriptions, but not a fundamental working knowledge which comes from contact with the thing itself.

For a school situated as above, much time should be devoted to stream erosion and sedimentation, to the formation of the rocks and their decay to soil; the relation of plant life to the uplands and the lowlands, and human industries as dependent upon all these conditions. The skill acquired in working out simple geographical problems of this kind can be carried over into the wide field of geographical relations, so that wherever the pupil goes he is better fitted to interpret what he encounters.

The memory work in a course in physiography should be reduced to a minimum. Everything should be made as real as possible through constant appeal to experience, to specimens, to pictures and descriptions of the earth brought by travellers and explorers.

A course in physiography as outlined above gives a good foundation for commercial geography, economics, and the formal sciences. In addition it gives an outlook, places things in the proper perspective, and increases wonderfully the pupil's efficiency. The subject is better adapted to the immature minds of pupils at the beginning of their high-school course than is any one of the formal sciences, and has the additional value that it awakens interest and thus leads to the taking up of the later specialized work in the proper spirit.

There is constant danger that the laboratory work in physiography will become a matter of cold, formal routine. A prolonged study of maps, diagrams, and instruments is particularly to be guarded against. The ability to read and make use of contour maps is one of the essential things, but when students are kept for days examining them and discussing their significance, that spontaneous interest which sees in the maps a country which they may sometime visit and explore, the interest, and with it the value of the work, is lost.

Methods suited to university investigations are not the thing for first-year high-school pupils, and yet how frequently do we see this self-evident truth violated. One of the most serious defects of high-school teaching as well as that of the grammar school is the attempt to teach facts and use methods far beyond the pupil's interest and comprehension.

Physical geography or physiography is not taught in a large number of high schools. In many where it does appear in the curriculum the subject has no standing, but is taken as an easy and handy thing to fill up a course. In only a few schools is it made a required study for all pupils. The efficiency of the work is further handicapped by the current idea that anybody can teach physical geography. The old notion that all that is needed is the hearing of recitations from a text is still too prevalent, and so we find the work often turned over to the teacher who has the most time, without regard to whether he has any interest in, or qualifications for, the subject.

The lamentable lack of any work in nature study or physical phenomena in the seventh and eighth grades of most grammar schools leaves the pupils entirely unprepared for physiography, so that it is necessary to unduly emphasize the purely science side of the subject. This lack in the grammar school is bad enough, but the failure to recognize the importance of a broadly cultural subject like physiography as an introductory course in the high school is inexcusable. Physiography should fill the gap between nature study and science. Nature study is closely related to the geography of the grades, and science is but specialization applied to the materials entering into the all-inclusive subject of geography.

Geography has become a thoroughly organized science with definite content and definite objects to be accomplished. Beginning with nature study in the primary school we differentiate geography in the grammar grades. In the beginning of the high-school period we apply the enlightenment gained in nature study to the broad subject of geographic relationships, or in other terms physiography, and in the science of later years

we take up the various classes of earth phenomena entering into geography and study each for its own sake.

Let us forever clear our minds of the notion that there is any truth in the assumption made by some that physiography is merely science in disguise. It is neither geology, nor physics, nor chemistry, nor biology, nor a combination of them all. No one can be rationally substituted for it, since with a wide and comprehensive outlook physiography includes materials from every one.

Physiography has further the great advantage of being adaptable to the needs of pupils of different degrees of advancement, so that no one need leave school without getting some of its culture, or feel that he has learned all that there is in it when he has completed his university course.

I trust that the main points in the analysis of the subject of physiography as given above may meet with the approval of teachers, and that the ideas brought out will aid in placing it in the position of importance which it should occupy in the high-school curriculum.

RECENT PUBLICATIONS

CUBA: POPULATION, HISTORY AND RESOURCES, 1907; pp. 275. U. S. Bureau of the Census, 1909.

Includes accounts of general features of Cuba and a special account of commerce, transportation, population, etc., with customary tables of population, vital statistics and industries. Illustrated.

OUT OF DOOR STUDIES IN GEOGRAPHY, II. The Formation of Mountain Ranges. By Francis M. Fultz; pp. xv+96. Public School Publishing Company, Bloomington, Indiana, 1909.

A supplementary volume dealing with the Sierra Nevadas. Well written and illustrated. Includes as an appendix a description of each illustration with questions for picture study.

PRACTICAL GEOGRAPHY. By Frederick Mort; pp. 71. London, Blackie & Son, 1908.

A series of exercises on maps, projections and simple surveying, containing many suggestions adaptable to high school pupils.

A RATIONAL GEOGRAPHY. Part I. By Ernest Young; pp. xii+206. London, George Philip & Son, 1908.

This volume, devoted to Climate, the British Isles and Europe, is a suggestive book with a commercial flavor, of value to teachers in America who desire references for teaching European geography from the causal standpoint.

THE CLIMATE OF CLEVELAND, OHIO

By W. M. Gregory
Cleveland Normal School

NORTHERN Ohio offers many problems in simple meteorology that should have a prominent place in local school geography. Its location in the north temperate zone within the interior of the continent, and south of one of the great lakes, gives a complex character to its climate. The state being in the belt of the prevailing westerlies and mid-continent in its location, the "whirling storms," consisting of the great circling masses of air called "high" and "low" areas, are well developed, and as northern Ohio is in the average path of their eastward movement across the country, its weather is a continuous repetition of the atmospheric changes that accompany these areas.

The elements of the weather, the pressure, the temperature, the winds, the precipitation, the cloudiness, etc., are all capable of being made the basis of observations full of vital meaning in the every-day life of the student. The ease with which weather material for practical use may be obtained makes such studies form a very valuable part of geography. No long excursions are required to secure material, and a careful study of the climatic elements form a natural introduction to the complex study of land forms in relation to the activities of man.

The "high" and "low" areas, so-called from the barometric pressure at their respective centers, each have weather conditions which are marked and characteristic. The "low" is an ascending current of air of relative high temperature and low pressure, accompanied by some rainfall; in the eastern half the winds are from the south and in the western half from the north, and the sky is usually cloudy. The "high" is a descending air current with a relative low temperature, a high pressure, clear sky, no rain and cold winds. These areas disturb the regular atmospheric conditions frequently by producing storms and high winds, and they influence shipping, railroad traffic, and the general activities of the people to such an extent that the United States Government expends a large amount each year to watch these rapidly changing conditions, and issues daily weather maps, warnings and special forecasts of the weather. The weather changes which these areas bring to Cleveland are characteristic of the temperate zone over the land. These areas bring certain types of weather in the various seasons; the changes are the most rapid and pronounced during the winter.

Northern Ohio, lying just south of Lake Erie, has its temperature mitigated in the extremes of cold and warmth by this great body of water which stretches eastward from Toledo to Buffalo. The water absorbs the heat slower than the land, and a hot, dry day in the summer is warmer a short distance inland than on the lake shore. In the winter the lake holds to a marked degree the heat, and does not allow the temperature along the lake shore to fall. This influence of the lake upon the temperature may be clearly shown by comparing the range of temperature at Cleveland with that of an inland city, or making similar comparisons with the variations in temperature of a city of the same latitude as Cleveland, but away from the lake influence. The absolute range of temperature of 139 degrees at Des Moines, Iowa, which is in the same latitude as Cleveland, when compared with the range of 116 degrees of this city, illustrates the temperating effect of extremes by a great body of water. Within the interior of the State of Ohio the range of 124 degrees at Columbus, 142 degrees at Coalton, and 136 degrees at Wauson, when compared with the range at Cleveland and other lake ports, again reveals the mitigating effect of Lake Erie upon extremes in temperature. The lake influence affects in a marked manner the growth of the vine in this region. Some authorities state that the vineyards flourish in northern Ohio because of the ample opportunity in the fall for the fruit to ripen, and the moderate range of temperature. These conditions, along with the favorable soil, account for the concentration of the vine products of the state on the south shore of Lake Erie in the Sandusky and Put-in-Bay district.

Still, in spite of the moderating effect of the lake, the cold days that come to the lake ports in January and February are penetrating and chilling to a degree that is unknown in the very cold weather of the western plains, where the air is very dry. The rapid changes in temperature, accompanied by damp, cold winds in mid-winter, affect the health of the people to a marked degree. Colds, chills, pneumonia, influenza, diphtheria, etc., are characteristic diseases which are prevalent here at the season when the time of sudden changes is at its maximum.

The average temperature of Cleveland is 49 degrees. This is very near the temperature of a dozen of the larger cities of the United States and Europe; the isotherms of 45 and 50 degrees mark the line of the early western migrations of colonial days. The early interest of the New Englanders was drawn to this region because of its soil, and the fact that the climate was inviting in its attractive features. As Manasseh Cutler

said of this region in 1787: "The advantages of every climate are here blended together." The location of the Western Reserve, a strip of land 120 miles long along the south shore of Lake Erie, was chosen for its fertile soil and the fact that the climate would be temperated by the influence of the water.

The wind plays an important part in the weather conditions, and this region being in the belt of the prevailing westerlies much variation in the strength and the character of the winds would be expected. At the western end of Lake Erie the southwest winds are the most common because the lake influence is not so strong to the windward, while at the eastern end of the lake, at Buffalo and Erie, the winds average from the southeast. The lake influence disturbs the regular course of the southwest winds by the land and lake breezes, which, combined with frequent changes of wind direction during the passage of the barometric areas, make the prevailing winds at Cleveland from the southeast. The eastward drift of the upper air currents is shown by the higher clouds. The great balloon race which started from St. Louis, Mo., in June, 1907, was a clear demonstration of the eastward drift of the westerly winds over Ohio. One of these balloons near the eastern end of Lake Erie was carried back a considerable distance in its course by the local lower air currents, while by the upper east flowing currents, the winner of the race was carried to the northeast.

In a great belt of country along the lake shore the land and lake breeze is well developed in the summer, because the difference in temperature of the land and the lake is greater in the summer months. The lake breeze grows stronger each day in the spring until July, when it appears regularly each morning, much to the comfort of a crowded, overheated city. In the fall the warm, moist winds from the lake are chilled by the cold air over the land, causing heavy fogs which delay movements of the boats in the river and along the shore. The winter winds compared with those of the summer are stronger, more irregular, and more characteristic of the westerlies in direction and in their storms. The winter "thaws" come from the warm, south winds, and are invariably followed by a "cold wave" bringing cold northwest winds and low temperature. The rainfall of northern Ohio is nearly 35 inches for the average year, while it has been as much as 53 inches and as scarce as 23 inches. It is generally supposed that more rain falls near the lake than inland; such is not the case, for all of the cities in the center of the state have an average rainfall of over 40 inches; this is partly due to the greater elevation of the land

south of this region. The largest amount, over 60 per cent., of the rain falls during June, July and August, which is fortunate, for these months constitute the growing season, and truck gardening is at its height. During these months severe thunder storms are frequent, and they are often accompanied by rainfall so heavy as to form cloudbursts, which in a short time do considerable damage to crops and property. The formation of these eastward moving thunderstorms with squall cloud, dust whirls, rain curtain, thunder-heads, lightning and the high overflow is a common occurrence in mid-summer and one of the chief sources of the summer rainfall. The months of August and September are frequently times of great droughts. In the past season of 1908, many sources of water supply for farmers and villages about Cleveland were dry, and water was hauled some distance from muddy creeks or the lake. In some places in northern Ohio during the drought of the past year, drinking water has sold at ten cents a gallon; factories have been closed; stock often driven six to ten miles for water, and small towns have carefully conserved their water supply for fire protection.

Cleveland's water supply from Lake Erie is practicably inexhaustible, but at the close of each drought the heavy rains bring much contamination to the lake, and the number of typhoid cases in the city increases correspondingly. The snowfall averages about 50 inches and is equivalent to about one seventh of the rainfall. The slight covering that the snow affords has been believed to make this region one especially adapted to the growth of winter wheat. The moderate range of temperature is a more vital factor in wheat-raising, and the decrease in the total wheat acreage is due not to climatic changes, but rather to soil exhaustion and various economic changes. Cleveland often has more rainy days in a year than any other city of Ohio; but not as much rain as places of fewer rainy days and heavier storms.

Cleveland is remarkable for its large number of cloudy days, exceeding all other cities of the state. This is not due to general climatic conditions, but rather to the valley location of the city and its industrial plants. When the city is seen from a distance it is covered with a great, gray cloud. It is estimated that over 100,000 tons of coal are daily consumed in the boilers of the city, and although there are more than 100 smoke consumers in operation, the merchants of the city estimate that, due to the smoke and soot, there is an annual loss of 25 per cent. on all white goods sold. The red ore dust from the iron furnaces is carried a considerable distance, and its effects have been the subject of many lawsuits for

damage to the property in the near vicinity of the furnaces. The city forester estimates that 20 per cent. of the trees lost in a year are due to the atmospheric conditions brought about by the smoke and the dust in the air. Because of the cloudiness the sunsets are always richly colored and the twilight arch in the east is seldom seen.

In the belt of land bordering the lake, the first killing frost comes about the 24th of October, while in the central part of the state the first frost comes one to two weeks earlier. The same is true in the spring, when the last frost comes about the 20th of April, while in the central part of the state it is the middle of May before the danger of a heavy frost is past.

In the study of geography as the relation of man to the earth, there is perhaps not one of the geographical features more important in its effects upon the life of a city than the climate. The change in this city from a summer to a winter season, with its frozen lake, brings a vast change in the occupations of thousands of men employed in ore, freight and passenger transportation by boat; dry docks are then active, and the coal accumulates on the docks for the first spring boat, while building operations are largely suspended, paving and sewer construction is confined almost entirely to the summer months. During the fall, and after the great harvests of the northwest, there is always a rush to get the grain to the city. If the fall storms are severe the freight rates are high on the lakes, thus directly affecting the price of flour. The coming of the cold season affects the commission business; the vast quantity of stuff, if shipped at all, has to be consigned at such times as the weather conditions will permit, and many of the fluctuations in the prices of the staple vegetables are due directly to a great loss by frosting of shipments. Transportation of all kinds is vitally affected by the winter weather changes. Heavy snow or dense fogs may delay street cars so that thousands of people are delayed in business engagements, and the labor of the day. Sleet storms often cripple telephone and telegraph service for several days, while the heavy floods following the spring rains may swell the rivers so that communication by rail is prevented, and there is serious damage by washouts and floods to railroads in the river bottoms. Certain classes of merchants follow very carefully the weather conditions so that the display of goods may suit the weather.

There are many vital reasons why the study of the local climate should occupy a prominent place in the geography of the elementary grades and the high school. In the high-school physiography climatic studies form

a fitting introduction to the consideration of land forms in their relation to man. In the grades a study of the elementary facts of weather furnish excellent material for observational work and supplies numerous types for comparative studies of other regions. In the Cleveland region, as that of other large cities, there exists an abundance of material which should be freely used for class illustration and study.

The following list of papers will be a valuable aid to the study of the local weather and climate of northern Ohio:

1. *"Cleveland Weather,"* by G. A. Hyde, *Journal of Association of Engineering Societies,* December, 1905, Vol. 35, No. 6, p. 171.
2. *Annual Summary for 1908 of the Cleveland Weather Bureau.*
3. *Ohio Climate and Crop Service.* Annual and Monthly Summary. Columbus, Ohio.
4. *Ohio Climate and Crop Service.* Monthly Summary for 1905. Résumé of Cleveland climate.
5. *"Climatology of the United States,"* by Henry. Special article and data on Cleveland climate.
6. *Weather Bulletin No. 184.* Explains use and care of instruments.
7. *"Weather Bureau and Public School,"* by J. R. Weeks in *Year Book of Agriculture* for 1907.
8. *Explanations of Weather Map.* Issued by the United States Department of Agriculture, Washington, D. C.
9. *"Meteorology in School,"* by W. M. Davis in *School Review,* Vol. 11, p. 229.
10. *"Weather Bureau Stations and their Duties,"* by J. Kenealy, observor at Cleveland. *Year Book of Agriculture* for 1903.
11. *"Weather in the North of the United States,"* by Moore in *National Geographic Magazine,* 1900.
12. *"Weather Forecasting,"* by Willis L. Moore in *Weather Bureau Bulletin No. 191.*
13. *Practical Exercises in Meteorology,* by Ward.
14. *Climate Considered Especially in Relation to Man,* by Ward.

NOTES

A SANER VIEW OF GEOGRAPHY.—As a reaction against the old method which made of geography little more than an exercise in merely finding, naming and remembering the positions of places as indicated on a map, another extreme was often resorted to in many schools of practically omitting map study and making of the geography lesson a sort of entertainment. This consisted largely in oral descriptions and pleasing stories by the teacher, telling of things and conditions of life in far-away lands. Then there were pictures in abundance, and sand modeling, and the collection of a great store of samples of commercial products, and much supplementary reading. But the reading often led far afield from anything that could be properly called geography. If Nova Scotia was in the geography lesson, Evangeline was read; if the Grecian Archipelago, then stories from Grecian mythology were dragged in.

It would be unwise to condemn any sincere effort to infuse interest into a lesson, provided the enthusiasm of the teacher is tempered by good judgment. But those who have occasion to examine the people who have been taught what has too often passed for geography in recent years, find that the students of the most entertaining teachers do not know where places are. They can tell you about the stories of Norse mythology, and about the Laplanders and their mode of life, but they do not know whether Bergen is in Denmark or Holland, on the Rhone or the Danube, or whether the principal city of Spain is Brussels or Milan, on the Rhone or the Tiber.

The ablest students of geography see the need of calling a halt to the mere entertainer who would ignore or slight the map work. Probably no man in America is a closer or more intelligent observer of school methods in geography and their effects in training pupils to a real mastery of the subject than is Dr. Jaques Redway. Here is what he recently said touching this subject:

"A critic, recently complaining of the conventionalism of geography teaching, claims that it is far more satisfying to read of the beauties of Lake Katrine than to learn its latitude and longitude. To this I quite agree; nevertheless, it strikes me that an intellectual repast on the beauties of the lake, without an earthly idea of its locality, is not a very satisfactory meal. Lake Katrine is an incident in literature rather than one of geography; and if one happens to be studying the physiography of tarns, any other lake of the region will answer quite as well. The scenic

features are a part of the origin and physical history of about every lake in Scotland; the trade route is the chief thing about the Great Lakes; and the commerce of asphalt is the important thing about Pitch Lake in Trinidad. The capable teacher does not mix traffic problems with Pitch Lake, nor asphalt with Lake Katrine. But she knows enough to see that, in the discussion of the utility of the lake, the location of it shall become a part of the pupil's knowledge. In other words, the locality is an incident in the study of the features, and not a specially imposed memory task. To put it still more epigrammatically, the fundamental questions of geography are—what, where and why."—From *The Western Teacher,* March, 1909.

THE USE OF ELEPHANTS IN BURMA.—About the only old-fashioned, though none the less picturesque feature of Rangoon, is the work of the elephants in the teak yards. These huge beasts work with mechanical precision and appear to be endowed with a love of neatness and a certain sense of responsibility and reasoning. They work steadily and stolidly, without attempting to "soldier," and never collide with other elephants nor get their trunks mixed up with machinery, no matter in what close quarters they may be working. The elephants are used in various capacities. Some of them receive the teak logs that have been floated down the river from the forests, and tow them ashore. Then they drag the logs to the sawmills, either rolling them with one foot while they walk on three, pushing them with their tusks, or pulling them with a chain attached to a breast strap. Inside the sheds the elephants display the most intelligence. The big beast selects a log, picks it up with his tusks, kicks it up to the saw with his toes, then, forming a sort of knot with his trunk, he holds the log against the teeth of the saw while it is made into boards, pushing aside the outside slabs as soon as they are cut off and adjusting the log so that the board will be of the proper thickness. When the boards are sawed he takes them in his trunk and puts them in neat piles, being careful that they are laid on regularly, and standing at a distance he eyes his work to see if every board is evenly laid. If he finds a board out of place he carefully adjusts it. Sometimes it appears as if the working elephants talk to each other when laboring in pairs. A couple of them will pick up a large log with their trunks, march with it to the place where it is to be piled, and, with peculiar grunts, first one will let down his burden, then the other, making queer sounds during the operation as if suggesting or directing.

Elephants are used in Burma for many purposes. The young calves

are ridden like horses, with a soft pad and stirrups. They are found especially valuable in bad country, and may be ridden fifty or sixty miles a day. A tap on the side of the head, a slight pressure of the knee, or a word whispered in the ear, is all that is required to guide them. It is not at all a difficult matter for an elephant in prime condition to outrun a fast horse. They have one great failing, however,—they are unable to jump, and a deep ditch six or seven feet wide is absolutely impassable to them. The farmers in the rice fields of Burma hitch elephants to their plows, and the immense animals go splashing through the mud, dragging after them an implement that is almost invisible, so small does it seem when compared with themselves. The elephants that are used in hunting tigers are much more expensive than the ordinary laborers, as it is more difficult to train them to stand still when the guns are fired. Thousands of dollars are invested in a single hunting elephant.

It is interesting to watch the elephants when they are being unloaded from the steamer in the harbor of Rangoon. Most of those seen in Burma are shipped from India. The Burman woods also furnish elephants, and these are the largest of all the Asiatic elephants. In order to load and unload them they are lifted by means of a powerful crane and by a sling harness attached to cables. They become terrified when they find themselves suspended between heaven and earth, trembling and trumpeting and becoming fairly crazy with fright.

The laboring elephants are in their prime when they are twenty-five years old. They are expensive to feed, literally eating their heads off. It is declared that an elephant eats a quarter of his weight in feed every day. Certain it is that the average amount required to keep one of the gigantic workers in good condition is eight hundred pounds a day. While perfectly tractable and reliable when properly tamed and trained, an elephant is likely to become frightened and stampede without warning. In spite of his massive body and immense strength, he is timid in the extreme and becomes frenzied at the sight of a rat, a dog, or an automobile. Every elephant has a small hole in the side of its head, from which, periodically, a white fluid is discharged. Unless the animal is trained during the entire period of this discharge, he is liable to turn rogue and kill everybody within reach. At other times he is easy to manage. The time is not far distant when the elephants will disappear from the lumber yards of Rangoon to give place to modern machinery, which is much cheaper and more reliable than animal labor. Even now

they are vanishing, but a few old ones may still be seen doing their work in the mills and yards.—From *The Southern Workman,* May, 1909.

MAP DRAWING AS A PART OF SCHOOL WORK.—The most important thing to know about map drawing is what to avoid. The term includes productions of very varied character, from the rough sketch made in a couple of minutes, through maps of every degree of detail, up to the elaborate drawing with colored contours that has occupied many hours of careful toil. But for our present purpose it will suffice to divide all maps into two classes, the sketch map and others; and the second class, everything beyond the sketch map, everything, one may say, in which time is spent on the drawing, as distinguished from the facts, means time wasted.

Unfortunately there can be no doubt that much time is still lost in this way; if the fact were not otherwise notorious, the books and maps that publishers find it worth their while to issue would prove it—books and maps that have no other end than to lead men to squander precious hours in disguising from their class the true aim of geography.

The evil begins when time that might be spent on geography is spent on learning to draw. The range of geography, the range of the most modest syllabus yet printed, is so great that it is impossible that a class shall ever have exhausted it, impossible that they shall ever have nothing better to do than to draw maps. To take a concrete example: which class has advanced furthest towards a comprehension of geography—one that can draw an accurate outline of the British Isles, or one that, given an outline of the British Isles, can put on it approximately the isotherms of 60° F. for July, and of 40° F. for January; or, given a relief map of Europe, can put on it the lines of 30, 20 and 10 inches of rainfall? Yet either of the latter sets of lines, with some at least of their enormous geographic significance, can be *understood* and learned in a fraction of the time required for the outline. It is a matter of first-rate importance such as this that must be sacrificed if elaborate map drawing is to be practised. The thing is absurd.

It may sometimes happen that the drawing master is willing to teach a class to draw a map. That is excellent. The boys are learning to draw, and may conceivably learn a little, a very little, that will help their geography: a minute fragment of topography; or, less probably, the difference between latitude and longitude. That is a very different thing from giving up to the practice of drawing any of the too scanty time assigned to the study of the earth and its distributions.

For there is nothing inherently harmful in the elaborate map unless the time spent upon it be out of proportion to its importance. If it be, not only is time wasted, but a false idea is given of the relative value of different parts of the subject. Now unless a boy devote his whole school time to geography alone, the time spent upon a really elaborate map *must* be out of proportion to its value. Or, to take a commoner case, if a boy has three hours a week for the subject—and that is probably above the average—then if he devotes one hour in the term to drawing a single map, the time he has given to it is out of proportion to its value. For, as has been already hinted, what he has thus learned is nearly valueless. Topography is no doubt a part of geography, though not perhaps a part of first-rate importance in the early stages of education, but even of that he has learned not nearly so much as he might have done by drawing at different times half a dozen sketch maps, taking two or three minutes each; the outline he has drawn has been hidden from him by the detail, just as the general direction of a river is not impressed on the mind that is occupied with its less significant windings. The fact is, the whole process tends to obscure the significant by overlaying it with the trivial. The small detail which takes up the time in such drawings *can not* be reproduced from memory; what can abide in the mind and be reproduced is the generalization that a sketch map gives.

Yet the relative position of town, river, and mountain is of fundamental importance, and there is probably no way of impressing it on the average pupil so good as drawing it. But his attention while drawing it must be on the facts represented, not on the finish of the drawing by which they are shown. It must be remembered that the ability to copy a map neatly and accurately in detail is in itself a mere accomplishment, valuable only to a professional cartographer; what a boy needs to learn is to seize the elements that are essential to the point to be illustrated, and to put down on paper those and no others, roughly it may be, but effectively, with the least possible expenditure of time.

To begin with the last clause, "the least possible expenditure of time" involves the liberal provision of outline maps on which to insert the required facts, whenever the area is at all complex. Thus, most continents, if not all, should be provided, and any other areas the drawing of which would be difficult or lengthy—for example, the British Isles. And since so many of the facts that have to be inserted are immediately dependent on the relief, this should, as a rule, be provided too. For almost all purposes the best possible "blank" maps to provide are those which show the relief

by colored contours and have the rivers on them; and they are most useful when they differ from those in the atlas used by the class only in not having any names on them. Areas of simpler outline, *e.g.*, Italy or Spain, or perhaps Australia or South America, may be drawn by the pupil provided he is prevented from lingering over detail. On these last, on sketch maps of river basins, and on some others, the relief has to be inserted. This may be done expeditiously with the aid of a convention which simplifies much of the work. Let it be understood that red indicates high elevation, high temperature or high pressure, and blue indicates low, and a vast amount of explanation on both sides is saved. Thus, if a boy, provided with a red and blue pencil, draws a red streak in a sketch of a river basin, it is recognized, even without a name, as a line of hills.

Or if the teacher in putting the distribution of pressure on the blackboard draw some isobars red and others blue, the direction of the gradient is apparent without writing the figures on the lines. Indeed, it is not long before the eye recognizes the direction of a gradient of any kind without consciously going through any argument as to the signification of the colors. In this way the distribution of temperature, pressure, or relief can be put on a map rapidly and roughly, but effectively. In school work the relative changes of an element are wanted far more frequently than its absolute value. If it be desired to explain the monsoons, what is necessary is to show for summer and for winter two or three isobars and the direction of the gradient; that much boys can understand, and remember, and reproduce. It is neither necessary nor possible for them to remember the mean value of the pressure in different parts of the continent. Thus they can give the gist of the matter by a couple of lines, one red and one blue; and—no small incidental advantage—a glance tells the teacher where a mistake has been made.

We said such sketches should be "rough." The careful measurement of small detail does not improve a boy's map in any degree. It can not represent the facts with authoritative accuracy; it is not wanted for that purpose. His object in making it is quite different: to explain—to himself if it be in his notebook, to the examiner if it be in an examination paper—the point which he is describing in words; sometimes it may altogether take the place of a verbal description. For such a purpose bold treatment, which emphasizes the matter under discussion and subordinates or omits all else, is not only effective, but shows that the pupil has grasped the point at issue.

This brings us back to the first condition we prescribed for a satis-

factory map, that "it should contain the elements essential to the point to be illustrated and no others." That holds throughout school work. Maps that contain everything there is to be known about a region, as some maps try to do, are of no use for schools. You must have a separate wall map for each phenomenon you wish to explain, whether it be relief, temperature, pressure, rainfall or vegetation. You constantly want to use one of these in connection with another; indeed, the final mental picture of the region should combine them all; but to be clearly comprehended by a class, each phenomenon must be presented separately. This refers to the first presentation of the phenomena; they are not permanently dissociated. A class, to use a previous example, could not be expected to put the distribution of rain in Europe on to a blank sheet of paper, or even on to a sheet containing the coastline and no more. But an average class will make a very decent map of European rainfall if the pupils are given a relief map on which to put it. But they will have comprehended it most clearly if they originally saw it on the wall on an outline map containing nothing else at all, hanging by the side of the relief map. The relation between the two which would, of course, be continually referred to in the discussion of the facts by the teacher, becomes real to the pupils when they copy the rainfall on to such a "blank" relief map as is described above, for insertion in their notebooks.

To sum up. Sketch maps and diagrams can not be too frequent. Almost every point discussed can be so illustrated, and benefits thereby. It is generally easier to reach a boy's mind through his eye than through his ear. Do not then let him slowly elaborate one map showing much detail, but draw rapidly many small maps, or maps each illustrating a single feature, carefully excluding from them everything not immediately to the point.

Closely allied to the question of what maps a boy should make is the question of how much he should be taught about the making of maps by others. He should certainly understand the main principles which underlie the maps with which he is provided. He should have, for example, a general knowledge of the process by which the maps of pressure and temperature are produced. A description of the work that precedes the issue of each of the daily weather charts (which should be posted in every school) always interests a class. A good many people know that barometric readings are "reduced to sea level" before they are put on a map, though fewer could tell you what that process means, or why it is gone through. But what proportion of the adult population have any idea that

observed temperatures generally undergo a similar treatment? A satisfactory reason might be harder to give than in the case of pressure.

It is still more important that boys should realize that all maps are necessarily inaccurate in shape or area, or, more usually in school maps, in both. The few networks of latitude and longitude which are produced by projection in the mathematical sense of the word could only be comprehended in the higher mathematical sets of a school. They should certainly be taught to any boys advanced enough to undertsand them, but it should be done in the mathematical hour. Of the conventional and arbitrary methods by which the great majority of networks are produced a few typical examples should be explained, in order that the pupil may realize in what directions the different methods depart from the truth, and thus get an idea of the principles which govern the choice of a projection for a particular purpose. Probably a cylindrical orthomorphic (Mercator's), a homalographic equal-area (Mollweide's), and a conical projection would suffice. The one necessary precaution is the constant contrast of these or any other projection that may be used with the globe.—From *The School World.*

REVIEW

ELEMENTARY STUDIES IN GEOGRAPHY.—By H. J. Mackinder. I. Our Own Islands. 2. Lands Beyond the Channel. George Philip & Son, London.

The two supplementary readers listed above are small, attractive volumes written by a geographer who sees and interprets his surroundings and who knows how to write for children. The books, though written in the personal way as if the readers were taking an imaginary railway journey, are not merely a series of car-window glimpses glowingly described by an ungeographic personal conductor. The hand of a master is seen in the choice of materials, in the point of view with which the subject is approached and in the keen human sympathy evidenced by the attractive descriptions of life and its surrounding conditions.

The first volume is less adapted to American needs than the second, as the title would indicate. The second volume, devoted to Europe and the Mediterranean lands, is wonderfully attractive in form and content. It appeals to an adult and would make an excellent volume for use in the intermediate grades in this country.

R. E. D.

GENERAL LIBRARY
UNIV. OF MICH.
JUN 30 1909

The JOURNAL of GEOGRAPHY

VOLUME VII June, 1909 NUMBER 10

AN ILLUSTRATED MONTHLY MAGAZINE Devoted to the Interests of Teachers of Geography in Elementary, Secondary and Normal Schools

Edited by

RICHARD ELWOOD DODGE

Professor of Geography
Teachers College, New York City

CONTENTS·FOR JUNE

		Page
Physiography—An Elementry Science Course in the High School	*HAROLD W. FAIRBANKS*	217
Recent Publications		226
The Climate of Cleveland, Ohio	*W. M. GREGORY*	227
Notes		233
Reviews		241

AUTHORS ARE PERSONALLY RESPONSIBLE FOR OPINIONS AND STATEMENTS EXPRESSED IN *THE JOURNAL*

$1.00 a Year THE JOURNAL OF GEOGRAPHY 15c. a Copy

Published by

TEACHERS COLLEGE, COLUMBIA UNIVERSITY, NEW YORK CITY

Entered as second-class matter November 8, 1907, at New York, N. Y., under Act of Congress of March 3, 1879.

THE JOURNAL OF GEOGRAPHY

Published Monthly, except July and August

AN ILLUSTRATED MAGAZINE Devoted to the Interests of Teachers of Geography in Elementary, Secondary and Normal Schools

Successor to the *Journal of School Geography*, Vol. V, and the *Bulletin of the American Bureau of Geography*, Vol. II

Edited by

RICHARD ELWOOD DODGE

Professor of Geography, Teachers College, New York City

Associate Editors

ISAIAH BOWMAN
Assistant Professor of Geography, Yale University, New Haven, Conn.

JAMES F. CHAMBERLAIN
Professor of Geography, State Normal School Los Angeles, Cal.

W. N. CLIFFORD
Southern High School, Philadelphia, Pa.

HENRY C. COWLES
Instructor in Botany, University of Chicago Chicago, Ill.

WILLIAM M. DAVIS
Professor of Geology, Harvard University Cambridge, Mass.

N. M. FENNEMAN
Professor of Geology, University of Cincinnati Cincinnati, Ohio

J. PAUL GOODE
Assistant Professor of Geography, Univ. of Chicago Chicago, Ill.

WILLIAM M. GREGORY
Professor of Geography, Cleveland Normal School, Cleveland, Ohio.

MARK JEFFERSON
Professor of Geography, State Normal College, Ypsilanti, Mich.

EDWARD D. JONES
Assistant Professor of Commerce and Industry University of Michigan, Ann Arbor

CHARLES F. KING
Master of Dearborn School, Boston, Mass.

EDWARD M. LEHNERTS
Assistant Professor Geology and Geography University of Minnesota, Minneapolis, Minn.

EDWARD VAN DYKE ROBINSON
Professor of Economics, University of Minnesota, Minneapolis, Minn.

ELLEN C. SEMPLE
Writer in Anthropogeography, Louisville, Ky.

FREDERICK STARR
Associate Professor of Anthropology, Univ. of Chicago Chicago, Ill.

RALPH S. TARR
Professor of Physical Geography, Cornell University Ithaca, N. Y.

SPENCER TROTTER
Professor of Biology, Swarthmore College, Pa.

ROBERT DEC. WARD
Assistant Professor of Climatology, Harvard

R. H. WHITBECK
Supervisor, Model School, State Normal School, Trenton, N. J.

Associate Editors for Great Britain and Canada

A. J. HERBERTSON
Reader in Geography, Oxford University England

JOHN A. DRESSER
McGill University, Montreal, Canada

Terms of Subscription: $1.00 a Year in Advance; Single Copies 15c. Price in all foreign countries in the Universal Postal Union $1.40 (10 numbers) postpaid.

All Communications should be addressed to

THE JOURNAL OF GEOGRAPHY
TEACHERS COLLEGE, COLUMBIA UNIVERSITY,
NEW YORK CITY

THE JOURNAL OF GEOGRAPHY

RULES OF PUBLICATION

The Journal of Geography is an Illustrated Monthly Magazine devoted to the interests of teachers of geography in elementary, in secondary and in normal schools. It is published every month, excepting July and August.

Price—The subscription price is one dollar a year, payable in advance. Fifteen cents a copy.

Postage is Prepaid by the publisher for all subscriptions in the United States, Hawaiian Islands, Philippine Islands, Guam, Porto Rico, Tutuila, Samoa, Canada, and Mexico. For all other countries in the Universal Postal Union add forty cents for postage.

Change of Address—When a change of address is ordered, both the new and the old address must be given. The notice should be sent ten days before the change is to take effect. Subscribers who fail to give notice of change are responsible for payment for all copies sent until notice is received. The post-offices do not forward second-class mail matter. Subscribers who do not observe this rule will not be sent duplicate copies.

Discontinuances—If a subscriber wishes his magazine discontinued at the expiration of his subscription, notice to that effect should be sent direct to the publisher, never to an agent. Otherwise it is assumed that a continuance of the subscription is desired. Do not ask the publisher to discontinue your subscription without paying all arrearages.

How to Remit—Remittance should be sent by Check, Draft on New York, Express Order, or Money Order, payable to order of The Journal of Geography. Cash should be sent in Registered Letter. Add ten cents for collection of checks on banks outside of New York City, Boston or Philadelphia.

Letters should be addressed:

THE JOURNAL OF GEOGRAPHY

Teachers College, New York City

Teachers College, Columbia University Publications

Teachers College Record—Founded in 1900. Published bi-monthly. $1.00 per year (5 numbers); 30 cents per copy. Reduced prices on certain valuable numbers. A special circular gives a table of contents of numbers already issued. Sample copy of latest issue for 30 cents.

Contributions to Education—A series of bound volumes on educational subjects. Twenty-two have been published. Prices ranging from 75 cents to $2.50. A descriptive price list will be sent on request.

Educational Reprints and Pamphlets—A series of educational monographs; some bound in paper and some in cloth. Price list will be sent on request.

Extension Syllabi—A series of pamphlets outlining courses in the Extension Department of Columbia University. Prices are 10 and 20 cents. List of titles on request.

Special Periodicals—The *Classical Weekly*, the *Journal of Geography* and the *Nature-Study Review* are published from departments of Teachers College. Request for circulars and sample copies should be addressed to the journal desired; but may be enclosed in letters to address below.

Address all communications to

BUREAU OF PUBLICATIONS
TEACHERS COLLEGE NEW YORK CITY

SCHOOL SCIENCE AND MATHEMATICS

A Monthly Journal for Science and Mathematics Teachers

It is the only magazine of its kind published in the English language. It gives new ideas and methods of scientific and mathematical instruction—and acts as a clearing house for all that is advanced and good in scientific and mathematical instruction. It is the official organ of many science and mathematics teachers' associations.

EIGHT DEPARTMENTS—
Botany, Chemistry, Earth Science, Mathematics, Metrology, Problems, Physics and Zoology

"Almost a necessity." Bruce Fink, Professor of Botany, Iowa College.

"The practical hints are valuable to teachers." H. C. Cooper, Ass't Professor of Chemistry, Syracuse University.

"I value the magazine highly. It is most excellently conducted." Jno. S. Collins, Ass't Supt. of Schools, St. Louis, Mo.

"The Problem Department is very interesting and adds greatly to the value of the magazine." H. E. Cobb, Professor of Mathematics, Lewis Institute, Chicago.

"I do not intend to dispense with the magazine as long as it continues as helpful as it has proven to be in the past." Etta M. Bardwell, Biology Department, High School, Ottumwa, Ia.

"I feel that 'School Science' should be in every high school. I shall be glad to further the interests of the journal whenever it is possible." W. M. Cobleigh, Department of Physics, Montana State College of Agriculture.

"I wish to express my appreciation of your magazine. It is a most helpful and inspiring pastime to read the sensible, to-the-point articles it contains." W. T. Heilman, Instructor in Mathematics, Central High School, Columbus, O.

"Your paper is not in the usual class of school papers. I wish to help along the kind of work you are doing." Geo. P. Bristol, Director Summer Session, Cornell University.

$2.00 per year. :: 25 cents per copy.
SCHOOL SCIENCE AND MATHEMATICS
440 Kenwood Terrace, - - - - - - - - - Chicago, Illinois

SCHOOL SCIENCE AND MATHEMATICS will be sent for *three months* for 50 cents to a new subscriber mentioning THE JOURNAL OF GEOGRAPHY.

DO YOU KNOW

the four essential requirements of HIGH-GRADE Printing? Let us tell you:

First—A PRACTICAL and ARTISTIC CONCEPTION of what the finished product is to be. Without it, satisfactory results are accidental.

Second—GOOD MATERIAL. Without it, good work is impossible.

Third—GOOD WORKMANSHIP. Without it, results are obtained only at an enormous loss of time and energy for both printer and client.

Fourth—CLOSE ATTENTION TO DETAILS and the personal supervision by practical people over each piece of work in its progress through the various departments.

Meeting all these conditions absolutely is our way—the MASON-HENRY way.

Place your next order with us and we will demonstrate to your entire satisfaction that we are printers of merit.

THE MASON-HENRY PRESS

SYRACUSE, NEW YORK